

## Engineering/Engineering Related

The following matrix indicates those courses deemed transferable among institutions listed across the top of the matrix. The numbers on the matrix represent the number of semester hours associated with the course at each institution and which institutions have agreed to transfer the commonly numbered course in each row.

A list of the academic discipline liaisons contacts for each institution are listed at the bottom of this document.

### Civil Engineering and Surveying

| Prefix | Number | Course Title                              | BSC | NDSCS |
|--------|--------|---|-----|-------|
| CT     | 111    | Engineering Drawing                       |     | 2     |
| CT     | 121    | Plane Surveying                           |     | 4     |
| CT     | 122    | Advanced Surveying                        |     | 4     |
| CT     | 131    | Soil Testing                              |     | 3     |
| CT     | 132    | Material Testing/Quality Control          |     | 4     |
| CT     | 142    | Construction Safety for Civil Technicians |     | 1     |
| CT     | 212    | GIS Applications                          |     | 3     |
| CT     | 214    | Highway and Street Design                 |     | 3     |
| CT     | 215    | Land Use Planning and Development         |     | 3     |
| CT     | 221    | Surveying Procedures                      |     | 4     |
| CT     | 222    | Advanced Surveying Procedures             |     | 4     |
| CT     | 223    | Boundary Control and Legal Principles     |     | 4     |
| CT     | 231    | Bituminous & Concrete Technology          |     | 3     |
| CT     | 232    | Water Management Technology               | 4   | 4     |
| CT     | 233    | Concrete Technology                       |     | 1     |
| CT     | 234    | Asphalt Technology                        |     | 1     |
| CT     | 241    | Statics and Strength of Materials         |     | 2     |

| Prefix | Number   | Course Title                               | BSC | NDSCS |
|--------|----------|--|-----|-------|
| CT     | 243      | Research and Analysis                      |     | 2     |
| CT     | 250      | Applied Statics and Mechanics of Materials | 4   |       |
| CT     | 251/251L | Materials Testing/Lab                      | 3/1 |       |
| CT     | 252      | Construction Project Management            | 3   |       |
| CT     | 261      | Machine Control & Project Layout           |     | 2     |

### **CT 111 Engineering Drawing**

This course is designed to provide the students with practice in the use of drawing instruments and basic drafting techniques as well as the application of these techniques in orthographic, isometric and section drawings.

### **CT 121 Plane Surveying**

Instruction and practice in the use of surveying instruments and equipment. Types of surveys, units of measure, elementary leveling, transit problems, field notes, and benchmarks are included. Survey transverse and triangulation calculations and adjustments including map plotting, latitudes and departures, open and closed traverses, error analysis, inverting between points, and intersection of lines are also covered.

### **CT 122 Advanced Surveying**

A study of advanced survey traverse and triangulation calculations and adjustments including: error analysis, subdivision of sections, contouring, route locations, grade determinations, earthwork measurements, map plotting, inverting between points and intersection of lines. Students also perform field work in stadia surveying, plane table mapping property corner searches, offsets, construction location and grade staking. Prerequisite: CT 121 and MATH 136.

### **CT 131 Soil Testing**

This course covers the actual "hands on" performance of laboratory and field tests on soils used for the construction of civil engineering projects. Most of the course is devoted to the lab and field procedures along with the necessary measurements, calculations and reports required for an accurate soil analysis.

### **CT 132 Material Testing/Quality Control**

This course covers the actual "hands on" performance of laboratory and field tests on soils and aggregates used for the construction of civil engineering, highway/heavy project, including the materials, design, placement, and testing procedures of freshly mixed and hardened bituminous and concrete mixes. Most of the course is devoted to the performance of standardized lab and field procedures along with the necessary measurements, calculations and reports required for an accurate analysis.

### **CT 142 Construction Safety for Civil Technicians**

This course will cover safety issues as it pertains to Civil Engineering and surveying Technicians. Most of the courses will be lecture, video, and group discussion. The course will also involve two outdoor labs. One consists of setting up a traffic safety zone and another entering into a confined space.

**CT 214 Highway and Street Design**

This course covers the fundamentals of highway and street design. Included in the course are design safety considerations, design cost effectiveness, geometric features, construction plan development, blueprint reading and other highway design criteria. A construction design project will be developed during the course. Prerequisites: CT 111, CAD 220, CT 221.

**CT 212 GIS Applications**

This course will provide the general knowledge and applications a student will need to perform advanced analysis of data, data management and file transformation, data collection and compilation of spatial data, web mapping and data in the cloud. This course will be based on hands on projects.

**CT 215 Land Use Planning and Development**

This course will take an undeveloped parcel of land and develop it into a residential subdivision. The parcel boundary will be surveyed in an earlier surveying class using a total station and data collector. The point file will be downloaded into Eaglepoint software for design and drafting use. Prerequisites: CT 221.

**CT 221 Surveying Procedures**

This course is comprised of field work, with emphasis on circular curves, vertical curves, slope staking, public land surveys and grade staking. The indoor work includes theoretical work in highway and railroad curve alignment, compound curves, reverse curves, superelevation, and spiral curves. Prerequisites: MATH 134, 136 and CT 122.

**CT 222 Advanced Surveying Procedures**

An introduction to geodetic surveying, electronic data gathering and processing, and astronomic observations. This course is a practical application of these surveying and engineering techniques utilizing both outdoor and classroom activities. Prerequisites: MATH 134, 136 and CT 221.

**CT 223 Boundary Control and Legal Principles**

The study of the laws and systems of land description and subdivision, including: history of land ownership; terminology used in Real Property Law; methods of property transfer; abstracts of titles; types of titles; filing and recording deeds; legal principles of retracements; reversing rights; riparian and littoral rights; mining claims; and preparation of metes and bounds descriptions and records of survey.

**CT 231 Bituminous & Concrete Technology****CT 232 Water Management Technology**

This course covers the fundamentals of water supply and distribution, water treatment processes, sanitary sewage and collection methods, sewage treatment, and the environmental effects caused by improper water and sewage handling. Included in the course are topics on hydraulics, chemical and biological testing, water distribution and collection systems and water and sewage treatment facilities. Prerequisites: MATH 134.

**CT 233 Concrete Technology**

This course covers the materials, proportioning, mixing, placing, finishing, curing, sampling and laboratory and/or field testing of portland cement concrete.

**CT 234 Asphalt Technology**

This course covers the origin, refining process, and properties of asphalt cement along with its uses as a cementing material in modern day street and highway paving projects.

**CT 241 Statics and Strength of Materials**

This course covers an introduction to static forces in equilibrium and their effects on objects. Included in the course are force vectors, moments, friction, stress/strain relationships, and the various properties of materials. The engineering method of analytical problem solving is stressed along with the neat and orderly method of showing the problem-solving procedure. Prerequisites: MATH 134, MATH 136.

**CT 243 Research and Analysis**

Engineering problems, design problems, inspection and testing problems, and data research connected with the office work of a civil engineering and surveying technician are covered. There is some work in cost estimating and analysis of advanced problems in surveying. Prerequisite: CT 221.

**CT 250 Applied Statics and Mechanics of Materials**

Equilibrium of rigid-bodies and coplanar forces systems, trusses, three-dimensional force systems, centroids, and centers of gravity. Introduction to stress, strain, torsion, shear stress and beam deflections, and mechanical properties of materials.

**CT 251/251L Materials Testing/Lab**

Introduction to physical and chemical properties of materials used in civil engineering projects including asphalt and portland cement along with the proper sampling, testing, and reporting procedures of these materials.

**CT 252 Construction Project Management**

An introduction to inspection procedures, management of quality controls of construction projects, and procedures used to administer construction specifications and contracts.

**CT 261 Machine Control & Project Layout**

This course will provide the skills necessary to setup control on a construction site, recreate 3d models for proper equipment operation, provide proper data for machine control, compute volumes of project and what is needed for quality control of a project.

**Engineering**

| Prefix | Number   | Course Title                          | BSC | NDSCS | WSC | MISU | NDSU | UND |
|--------|----------|---------------------------------------|-----|-------|-----|------|------|-----|
| EE     | 206/206L | Circuit Analysis/Lab                  | 3/1 |       |     | 3    | 4    | 3   |
| ENGR   | 101      | Graphical Communication               | 3   |       | 3   | 3    |      | 3   |
| ENGR   | 200      | Computer Applications in Engineering  |     |       |     |      |      | 2   |
| ENGR   | 201      | Statics                               | 3   |       | 3   | 3    |      | 3   |
| ENGR   | 202      | Dynamics                              | 3   |       | 3   | 3    |      | 3   |
| ENGR   | 203      | Mechanics of Materials                | 3   |       |     |      |      | 3   |
| ENGR   | 204/204L | Surveying I/Lab                       | 3/1 |       |     |      |      |     |
| ENGR   | 205/205L | Surveying II/Lab                      | 3/1 |       |     |      |      |     |
| ENGR   | 206      | Fluid Mechanics                       | 3   |       |     |      |      |     |
| ENGR   | 212      | Fundamentals of Visual Communications |     | 4     |     |      |      |     |
| ENGR   | 213      | Modeling of Engineering Systems       |     |       |     |      |      |     |
| ENGR   | 241      | Thermodynamics I                      | 3   |       |     |      |      |     |

**EE 206/206L Circuit Analysis/Lab**

Introduction to electric circuit components. Fundamental laws of circuit analysis. Steady state and transient analysis of DC and AC circuits. Electric power calculations.

**ENGR 101 Graphical Communication**

Course description will be finalized at a later date.

**ENGR 200 Computer Applications in Engineering**

The fundamentals of digital computer programming are presented with special emphasis on a high-level language and engineering applications. The fundamentals of PC-based software applications and operating systems are also presented.

**ENGR 201 Statics**

Vector approach to principles of statics. Resultants of force systems, equilibrium of force systems, analysis of structures, centroids, moments of inertia.

**ENGR 202 Dynamics**

Vector approach to principles of dynamics. Rectilinear and curvilinear translation, rotation, plane motion, force-mass-inertia, work-energy, impulse-momentum.

**ENGR 203 Mechanics of Materials**

Simple stress and strain, torsion, shear and bending moment, flexure and shear stresses in beams, combined stresses, deflections of beams, statically indeterminate members, and columns.

**ENGR 204/204L Surveying I/Lab**

Field and office problems using surveying instruments, measurements, and computations with emphasis on mathematics concepts. Prerequisite: Trigonometry.

**ENGR 205/205L Surveying II/Lab**

Compound and spiral curves horizontal curves, state plane coordinate system, U.S. public land surveys, boundary surveys, an introduction to geodetic surveying, electronic data collection and reduction, and astronomical observations. prerequisite: ENGR 204.

**ENGR 206 Fluid Mechanics**

This course covers fluid properties, fluid statics, fluid dynamics, transport theory and transport analogies, conservation of mass, energy and momentum, dimensional analysis, boundary layer concepts, pipe flows, compressible flow, and open channel flow.

**ENGR 212 Fundamentals of Visual Communications**

Part 1: Orientation of job functions in an engineering department along with learning tools of the engineering and technical management professions. Emphasis on hand sketching, print reading, drafting standards, engineering changes and revision documentation for manufacturing and industry. Part 2: Create visual communications of designs for manufacturing. Understand all phases of design and how to develop three dimensional models using Pro Engineer. Emphasis on sketching, parametric modeling of parts, assemblies, and critical dimensioning of orthographic drawings for manufacturing and industry.

**ENGR 213 Modeling of Engineering Systems**

Introduction to engineering systems, modeling, and computations; computer methods; analytical methods; verification tasks; case studies. Prerequisite: Calculus 165.

**ENGR 241 Thermodynamics I**

Fundamental concepts of thermal energy relationships, processes and cycles are introduced, including: first and second law of thermodynamics, entropy, and availability.

## Mechanical Drafting & Design

| Prefix | Number | Course Title                   | NDSCS |
|--------|--------|--------------------------------|-------|
| MECD   | 102    | Mechanical Drafting and Design | 5     |
| MECD   | 231    | Machine Design                 | 2     |
| MECD   | 241    | Engineering Drawing II         | 7     |
| MECD   | 244    | Engineering Drawing IV         | 7     |

### MECD 102 Mechanical Drafting and Design

A study of drafting techniques as they are related to manufacturing processes and methods. Included are techniques for dimensioning simple machine parts, screw threads, standard fasteners, keys, rivets, springs and sectional views. Uses techniques of drafting as they relate to descriptive geometry. Students will perform pictorial drawings including axon-metrics, obliques, perspectives, and illustrations.

### MECD 231 Machine Design

A basic study of machine design with respect to machine parts, structural members and mechanisms. The course covers the design principles and applications of machine elements, with attention to loading conditions, stresses, and other factors which affect the strength and function of machine parts. Students also learn vendor catalogue and machinery handbook usage and applications.

### MECD 241 Engineering Drawing II

A course combining lectures, discussions, and drafting practice. The problems consist of designing and laying out tools, gauges, jigs, fixtures, and dies. Mass production methods applying to tool and die design are covered. Drawing practice includes overall layouts, assemblies, drawing details, tolerancing, and checking procedures. CAD required to complete some projects.

### MECD 244 Engineering Drawing IV

A design drafting course involving the environment that will be experienced in the world of work. The course will involve the development of a design process, scheduling of production, costing, drawing of assemblies and details and presentations. Student projects may include electrical structural, electronic, and machine drafting (including tolerancing, costing and checking according to production methods). CAD required.

## Mechanical Systems

| Prefix | Number | Course Title                          | NDSCS |
|--------|--------|---------------------------------------|-------|
| MSYS   | 101    | Safety for Mech'I Systems Technicians | 1     |
| MSYS   | 103    | Math for Mech'I System Technicians    | 3     |
| MSYS   | 132    | Advanced Hydronics Systems Lab        | 2     |
| MSYS   | 141    | Introduction to Electricity           | 2     |
| MSYS   | 151    | Drafting and Sketching                | 2     |

### **MSYS 101 Safety for Mech'I Systems Technicians**

This course covers the safety issues that pertain to plumbing and HVAC-R. Participants will be required to adhere to the Technologies and Services Division attendance policy.

### **MSYS 103 Math for Mech'I System Technicians**

A basic math course with emphasis on development of useful skills in layout, measurement, and computation of pipe lengths, and fitting allowances, as well as a study of elevation, grade and volumes as it pertains to our trades.

### **MSYS 132 Advanced Hydronics Systems Lab**

This course covers Hydronic heating from boiler operation to Hydronic heating systems, forced air, convention, and radiant. the course includes classroom and laboratory assignments. Prerequisite: MSYS 131.

### **MSYS 141 Introduction to Electricity**

A study of basic electricity for plumbers including applications such as water heaters, pumps, hot water heating systems and their associated controls.

### **MSYS 151 Drafting and Sketching**

A practical course in drafting, sketching, scale reading, geometric construction, and interpretation of drawings. The principles involved are sufficient in dept to give the student the working knowledge and skills required for the major program areas.

The following individuals are liaisons for this discipline. Those marked with an asterisk (\*) are chairs.

| <b>Name</b>      | <b>Institution</b> | <b>Email Address</b>                 | <b>Phone Number</b>    |
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